Systematic Review

Return to Work or Sport After Multiligament Knee Injury: A Systematic Review of 21 Studies and 524 Patients

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Purpose: To systematically review multiligament knee injury (MLKI) outcome studies to determine overall rates of return to work or sport after MLKI and risk factors for lack of return to work or sport after MLKI. **Methods:** A search was performed of MLKI outcome studies from 1950 to March 1, 2017. Ninety-two studies were identified. All included reported return to work, return to sport, or Tegner activity scores. Rates of return to work or sport were determined for overall population and by obesity status, injury severity, and presence of peroneal nerve or vascular injury. **Results:** A total of 524 patients (21 studies) were included. Return to high-level sport was low (22%-33%). Return to any level of sport was 53.6% overall (178/332), with a higher rate reported in studies with all surgical patients (59.1%, 114/193 patients) versus studies with mixed surgical and nonoperative treatment (46.0%, 64/139 patients) ($P = .02$). Rate of return to work with little or no modifications was 62.1% (146/200) and return to any work was 88.4% (190/215). Obese patients had lower postoperative Tegner scores than a general population (obese: mean 1.7 ± 1.2; nonobese: mean 4.5 ± 1.0; $P < .001$). Among studies without Schenck grade IV and V injuries, return to work with no or minimal modifications (100%, 12/12 patients) was higher than studies including grade IV and V patients (66.0%, 70/106 patients) ($P = .017$). Return to any work was higher in studies without vascular injuries (96.3%, 105/109) versus those including them (80.2%, 85/106) ($P < .001$). **Conclusions:** Return to sport after MLKI occurs in approximately 60% of surgically treated patients, though return to high-level sport is lower. Return to work is frequently possible after MLKI though it may require workplace or job duty modifications. Obesity, nonoperative treatment, higher injury severity, and vascular injury are associated with poorer functional outcomes. **Level of evidence:** Level IV, systematic review of level III and IV studies.

Multiligament knee injuries (MLKIs) are rare,[1-3] and rates of functional recovery after MLKI are not well understood. Angelini et al.[4] found that knee dislocations accounted for 0.2% of orthopedic injuries. Plancher et al.[5] noted that the incidence in their sources varied from 38 cases over a 5-year period to 14 cases in 2 million admissions over the course of 50 years. MLKI is a serious injury that occurs predominantly in males[6-8] following high-energy trauma such as motor vehicle injuries and less frequently following sporting injuries.[5,7,9] However, a growing number of cases are due to very-low-energy mechanisms in low-demand, morbidly obese patients.[10] MLKI encompasses a spectrum of disorders, with MLKI often defined as any knee injury with concurrent anterior and posterior cruciate ligament (ACL and PCL) rupture or other combinations of ligament injuries.[1,4,8,9] Multiple surgical treatment options have been proposed, including early ligament repair[11] versus reconstruction with autograft,[3] allograft,[12] or synthetic scaffold.[13] The ideal timing of surgery is a subject of debate, though a review by Levy et al.[14] reveal improved outcomes with acute surgical treatment of MLKI compared with delayed surgical treatment or nonoperative treatment.

As a result of the rarity of MLKI and lack of consensus on ideal clinical management of this injury, existing

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MLKI clinical outcome studies are limited primarily to case series with varying treatment protocols.[13,15-18] Furthermore, there is nonstandardized reporting of outcomes following treatment of MLKI, with some studies using patient reports of return to activities such as work, sports, and ambulation and others reporting complication rates and still others reporting subjective patient satisfaction levels.[19]

Most reported MLKI treatment outcome studies have a limited number of subjects and, therefore, few studies have been able to make high-powered inferences into eventual outcomes.[15,16,20-22] One meta-analysis of MLKI reports that cruciate ligament repair may be equivalent to reconstruction in terms of patient-reported symptoms,[23] and 2 meta-analyses show that return to work and sport rates are improved with surgical treatment of MLKI.[24,25] However, the effect of other factors beyond surgical versus nonoperative treatment on return to work and sport rates remains unclear. The purpose of this study was to systematically review MLKI outcome studies to determine overall rates of return to work or sport after MLKI and risk factors for lack of return to work or sport after MLKI. We hypothesized that rates of return to sport and work will vary between surgical versus nonoperative treatment. We also hypothesize that functional outcomes will be worse with higher injury severity, concomitant neurovascular injury, and in morbidly obese patients.

Methods

Search Strategy and Screening Process

A standard search strategy was used to identify studies reported in the English literature (Fig 1) that met prespecified inclusion criteria (Table 1). A systematic review of the available literature was performed with use of PRISMA guidelines (Fig 1).[26] For the purpose of this review, an MLKI was defined as a grade II or higher injury per the Schenck classification: grade I (ACL or PCL injury), grade II (ACL and PCL injury), grade III (ACL, PCL, and medial collateral ligament [MCL]/posteromedial corner, or lateral collateral ligament [LCL]/posterolateral corner), grade IV (ACL, PCL, MCL/posteromedial corner, and LCL/posterolateral corner), or grade V (fracture-dislocation).[19] A Medline search was performed using the search terms "knee dislocation," "multiligament knee injury," or "multi ligament knee injury" on March 1, 2017. Among human studies reported in English, this yielded 2,630 hits. A total of 2,538 studies were eliminated because of failure to meet inclusion criteria (Table 1) based on information contained in the title or abstract. The full manuscripts of the remaining 92 MLKI treatment outcome studies were reviewed for all inclusion criteria (Table 1), including report of at least 1 of the following outcomes: return to work, return to sport, or Tegner activity score.[27] A total of 23 studies were identified that met all criteria. However, the 3 studies published by Fanelli et al.[28] appeared to contain overlapping patient populations. A 2002 publication reported on patients operated on in years 1994-2000, a 2012 publication reported on surgeries from 1994 to 2010,[29] and a 2014 publication reported on surgeries from 1990 to 2008.[30] Therefore, we elected to retain the 2014 publication as it had the longest length of follow-up and eliminated the remaining 2 publications, yielding a final total of 21 studies for inclusion in this review.

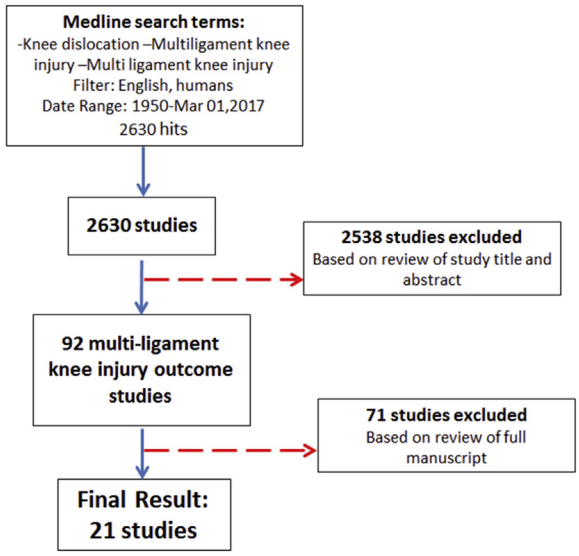

Fig 1. Systematic review flowchart. An initial Medline search was performed on March 1, 2017, yielding 2,630 hits. The titles and abstracts of these studies were reviewed and 2,538 studies were excluded based on the inclusion and exclusion criteria for this review (Table 1). The full manuscripts of the remaining 92 studies were reviewed, 21 of which met all criteria for inclusion in this review.

Data Abstraction and Quality Assessment

When available, patient gender, mechanism of injury, surgical treatment status, injury severity, peroneal nerve injury, vascular injury status, and length of follow-up were abstracted. Injury severity was defined according to the Schenck classification.[19] Each study was reviewed for level of evidence as well as quality according to the Methodological Index for Non-randomized Studies (MINORS) criteria, which has been shown to be a reliable and valid assessment of reporting quality for comparative and noncomparative outcomes studies. A maximum score of 16 is possible for noncomparative studies and 24 for comparative studies.[31]

Rates of peroneal nerve or vascular injury were determined by counts from studies that did not exclude patients with nerve or vascular injury. Return to any level of sport was defined as explicit statements